

device. Multipoint input devices have advantages over conventional singlepoint devices in that they can distinguish more than one object (finger). Singlepoint devices are simply incapable of distinguishing multiple objects. By way of example, a multipoint touch screen, which can be used herein, is shown and described in greater detail in copending and commonly assigned U.S. patent application Ser. No. 10/840,862, which is hereby incorporated herein by reference.

[0030] The computer system **50** also includes capabilities for coupling to one or more I/O devices **80**. By way of example, the I/O devices **80** may correspond to keyboards, printers, scanners, cameras, speakers, and/or the like. The I/O devices **80** may be integrated with the computer system **50** or they may be separate components (e.g., peripheral devices). In some cases, the I/O devices **80** may be connected to the computer system **50** through wired connections (e.g., cables/ports). In other cases, the I/O devices **80** may be connected to the computer system **80** through wireless connections. By way of example, the data link may correspond to PS/2, USB, IR, RF, Bluetooth or the like.

[0031] Particular processing within a touch-screen based computer is now described, where the processing accomplishes execution of an application as well as providing a display on the touch screen of the computer. The display processing includes providing a composite display that has characteristics based on the application display as well as characteristics relative to a virtual input device. The virtual input device display includes at least an input portion, to receive appropriate touch input to the touch screen relative to the displayed input device, for a user to interact with the virtual input device. The user interaction with the virtual input device includes activating portions of the virtual input device to provide user input to affect the application processing. The virtual input device (i.e., processing on the computer to accomplish the virtual input device) processes the user interaction and, based on the processing, provides the corresponding user input to the application.

[0032] The virtual input device display is typically highly correlated to the virtual input device processing of user interaction with the virtual input device. For example, if the virtual input device is a virtual keyboard, the virtual input device display may include a graphic representation of the keys of a typical QWERTY keyboard, whereas virtual input device processing of user interaction with the virtual keyboard includes determining which virtual keys have been activated by the user and providing corresponding input (e.g., letters and/or numbers) to the application.

[0033] We now turn to **FIG. 2**, which is a flow chart illustrating a broad aspect of the invention. In particular, the **FIG. 2** flow chart broadly illustrates a method by which behavior of a user's touch, with respect to a virtual input device displayed on a touch screen of a multipoint sensing device, is processed to affect a reaction to the user's touch. At step **202**, the virtual input device is provided on the touch screen. The virtual input device may be, for example, a virtual QWERTY-style keyboard or other input device having virtual keys.

[0034] At step **204**, a user's touch on the multipoint sensing device, to nominally activate a virtual key, is detected. Detecting a user's touch may be conventional. At step **206**, the "behavior" of the user's touch is determined.

The behavior is typically determined by processing signals created by the multipoint sensing device in response to the user's touch. Behaviors may be, for example, in the spatial domain (i.e., where on the multipoint sensing device the user touched to nominally activate the virtual key) or in the time domain (i.e., with what timing the user touched the multipoint sensing device to nominally activate the virtual key) and a combination of both spatial and time domain.

[0035] At step **208**, the determined behavior and predetermined characteristics associated with the nominally-activated virtual key are processed. At step **210**, based on the processing in step **208**, a reaction is determined to activation of the nominally-activated virtual key. Examples of predetermined characteristics are illustrated later in this description. Broadly speaking, however, the predetermined characteristics for a virtual key are characteristics associated with particular behaviors or ranges of behaviors of a user's touch to-nominally activate that virtual key.

[0036] **FIG. 3** illustrates using processing signals created by the multipoint sensing device in response to the user's touch in order to infer the pressure with which the user's touched the touch screen to activate a nominally-activated virtual key. Such processing is useful in the case where a pressure signal is not directly available from the touch screen, or to supplement a pressure signal that is directly available from the touch screen. The area **302** represents points on the touch screen that correspond to a particular virtual key. While the area **302** is a square, virtual keys need not be limited to being a particular shape.

[0037] Area **306** indicates (in a spatial domain) points on a touch screen that a user touched to nominally activate the virtual key of area **302**. Similarly, area **304** indicates points on the touch screen that a user touched to nominally activate the virtual key of area **302**. Which points are touched may be determined, for example, from the processing signals created by the multipoint sensing device in response to the user's touch.

[0038] Since area **304** encompasses more points than area **306**, the touch corresponding to area **304** was with greater pressure than the touch corresponding to area **306**. Furthermore, an indication of the actual pressure with which a virtual key is nominally activated may be inferred from the area corresponding to the user's touch.

[0039] While **FIG. 3** illustrates all of the points within areas **304** and **306** fall within the area **302**, this need not necessarily be the case. Furthermore, while **FIG. 3** illustrates using the user's behavior in the spatial domain to infer pressure with which a virtual key is nominally activated, in some examples, the user's behavior in the time domain may be used to infer pressure with which a virtual key is nominally activated. In other examples, a combination of the user's behavior in the spatial domain and the time domain may be used to infer pressure with which a virtual key is nominally activated.

[0040] Having described one particular example of behavior of a user's touch of a touch screen to nominally activate a virtual key, we now describe one example of processing to process the determined behavior with which the user nominally activates a virtual key and predetermined characteristics for the nominally-activated virtual key.

[0041] Referring to **FIG. 4**, this figure illustrates a table in which each row is for a different one of a plurality of virtual